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Fertilizing Barley

Cooperative Extension South Dakota State University

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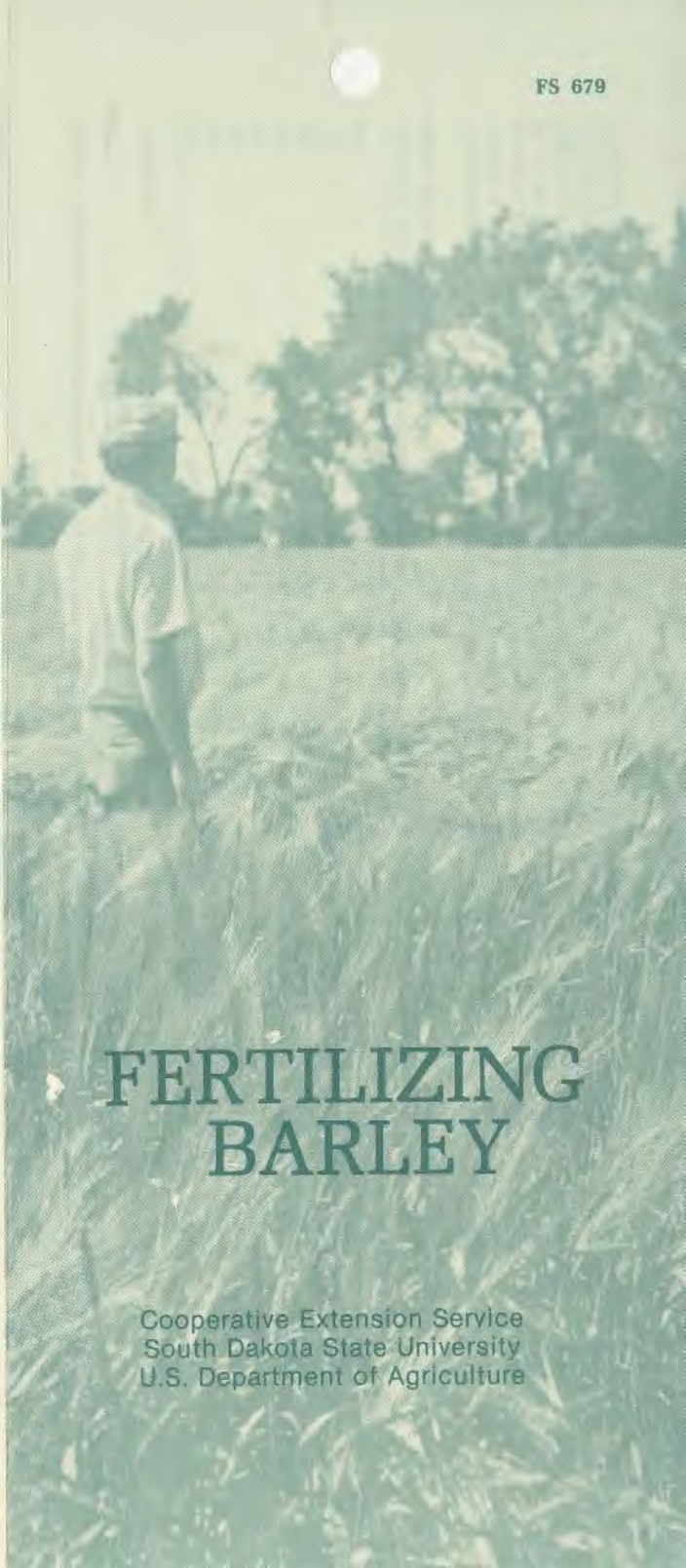

FERTILIZING BARLEY

Cooperative Extension Service
South Dakota State University
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High barley yields require large quantities of available plant nutrients. For example, the grain and straw portions take up approximately 1.5 lb nitrogen, 0.6 lb phosphorus (P_2O_5), and 1.2 lb potassium (K_2O) per acre.

In addition to the primary nutrients (nitrogen, phosphorus, and potassium), there are 10 essential elements necessary for plant growth. They are the secondary nutrients (calcium, magnesium, and sulfur), and the micronutrients (boron, chlorine, copper, iron, manganese, molybdenum, and zinc).

Most South Dakota soils can supply the necessary amounts of secondary and trace elements needed for maximum yields. The use of fertilizers containing these nutrients has seldom increased barley yields. Some South Dakota soils, however, can not provide the necessary amounts of nitrogen, phosphorus, and potassium required by today's high yielding barley.

Nitrogen

Nitrogen is the nutrient that limits barley yields most often . Barley is usually seeded in soil that is cropped annually. Additional nitrogen from fertilizer, manure, or legumes will nearly always increase barley yields, except where previous production practices have created high available nitrogen reserves. Barley seeded in fallowed soil may require little or no additional nitrogen. Above normal levels of nitrate-nitrogen will usually be found in fallowed soil following the noncrop year. The deep (0-2 ft) nitrate soil test can measure such reserves. Excess nitrogen needed for optimum plant growth and grain yield will usually result in higher protein levels; therefore, fertilizer recommendations are not made for malting barley unless the amount of soil nitrate-nitrogen in the top 2 feet is known. If a deep soil test for nitrate is not taken, a recommendation for feed barley will be given. Barley is very susceptible to lodging where excess nitrogen exists.

Date of seeding and weather conditions have a direct influence on yield, protein content, and response to nitrogen fertility levels. The best yields of malting barley can be expected if the crop is seeded before April 15th and weather conditions are not hot and dry. The probability of producing barley with a protein content of less than 13.5% decreases as the time of planting advances past April 15th.

The amount of actual nitrogen recommended for a desired yield of malting or feed barley can be determined by subtracting the nitrate-nitrogen soil test values from the total nitrogen requirement shown in Table 1.

Table 1. Nitrogen recommendations, malting and feed barley

Yield goal	Soil plus fertilizer nitrogen required[1]
bu/A	lb/A (0-2 ft)
40	60
50	75
60	90
70	105
80	120
90	135
100	150

[1]Fertilizer nitrogen to apply is equal to the value in the table minus soil nitrate-nitrogen to a 2-ft depth.

To estimate the fertilizer nitrogen needed (for feed barley only) without a 2-ft nitrate-nitrogen test, use the following formula based on the organic matter test: required nitrogen minus 30, 45, or 60 lb for a low (less than 2.5%), medium (2.5-4.0%), or high (more than 4.0%) organic matter test, respectively. If the previous crop was black fallow, substract an additional 45 lb from each category.

When a deep (0-2 ft) nitrate-nitrogen soil test is not taken, nitrogen needs can be estimated using the soil organic matter level. The organic matter test, however, does not measure the wide fluctuations of available nitrogen, and its use may result in recommendations for more or less fertilizer nitrogen than the crop actually needs. Therefore, when this test is used, nitrogen recommendations are made for feed barley only.

Phosphorus

Phosphorus applications as either fertilizer or manure are often needed to obtain maximum barley yields. Soil test level and yield goal will determine the amount of additional phosphorus that is needed (Table 2).

Table 2. Phosphorus recommendations

	Soil test phosphorus, lb/A				
	V. low 0-5	Low 6-15	Med. 16-25	High 26-40	V. high 41 +
Yield goal,	3	10	20	33	41
bu/A	lb P_2O_5/A recommended[1]				
40	28	26	20	10	0
50	34	31	24	10	0
60	41	37	28	11	0
70	47	42	31	13	0
80	53	47	35	15	0
90	59	52	39	17	10
100	65	57	43	19	10

[1]Recommendations listed are for the center of each soil test range.

Fallowing does not increase available soil phosphorus reserves as it does nitrogen. Soil phosphorus levels will not fluctuate from high to low in 1 or 2 years as will nitrate-nitrogen. Neither will they change from low to high in a few years unless fertilizer rates in excess of crop needs have been applied.

Phosphorus is converted to less available forms when mixed extensively with soil. This is part of the reason phosphorus fertilizer is more effective when banded with the seed using a drill attachment than when broadcast and worked into the soil. If phosphorus is band applied near the seed, recommended rates in Table 2 can be reduced by one third.

Small amounts of phosphorus placed with the seed have occasionally increased barley yields at high and very high soil test levels. Ten pounds of phosphorus (P_2O_5) applied as a starter on these soils may be necessary for maximum barley yields.

Potassium

Potassium uptake requirements closely match those of nitrogen. Most South Dakota soils contain very large reserves of available potassium; therefore, only small amounts, if any, are recommended as fertilizer. There are, however, a number of fields that test low in this nutrient. Potassium additions on these fields will be necessary for maximum yields. Potassium fertilizer recommendations are given in Table 3.

Table 3. Potassium recommendations

	Soil test potassium, lb/A			
	Low 0-100	Med. 101-200	High 201-350	V. high 351 +
Yield goal,	50	150	275	351
bu/A	lb K_2O/A recommended[1]			
40	39	32	0	0
50	50	39	17	0
60	60	47	20	0
70	71	54	23	0
80	81	61	26	0
90	92	68	29	0
100	103	75	32	0

[1]Recommendations listed are for the center of each soil test range.

Secondary and Micronutrients

Secondary and micronutrients are essential for high yields. Most South Dakota soils, however, have adequate available reserves of these nutrients. SDSU research has not shown significant profitable yield increases from fertilizer containing these nutrients. This may change with continued cropping and release of new varieties.

Fertilizer Application

Phosphorus and potassium should be applied before seeding and incorporated by tillage, applied by injection or applied with the seed at planting. Broadcast phosphorus rates can be reduced by a third when banded with a grain drill fertilizer attachment in a band in contact with or close to the seed. Nitrogen can be applied anytime before stooling with equal results. Later applications will not be as effective in increasing yields and will increase protein levels, decreasing the chance of successfully growing malting barley.

Thinner plant stands or reduced seedling vigor can occur if too much nitrogen and/or potash are placed in contact with the seed. This type of injury happens more easily in dry or sandy soils. The total amount of actual nitrogen plus potash placed with the seed in a drill attachment (6-inch row spacing) should be kept below 25 lb/A in such soils. If either urea or DAP (18-46-0) nitrogen sources are used, limit drill applications to 12 lb/A. Reduce these values correspondingly for wider row widths. These drill applications can be doubled for heavier textured, moist soils.

Topdressed nitrogen after seeding should be applied before stooling for best results. Lack of rainfall after topdressing can make it less effective than preplant incorporation.

Topdress applications of liquid nitrogen fertilizer are as effective as dry nitrogen when applied prior to stooling. Liquid nitrogen rates in excess of 25 lb nitrogen per acre can cause considerable leaf burn. Rates greater than 50 lb/A may cause enough leaf burn to reduce yield. Liquid nitrogen should not be applied once the flag leaf emerges.

Fertilizing Reduced and No-Till Barley

Limited adjustments in fertilizer rates and placement may be necessary with reduced tillage. Available nitrogen levels in soil are usually lower, resulting in higher nitrogen fertilizer needs. The deep (0-2 ft) nitrate-nitrogen soil test will measure nearly all change in available soil nitrogen levels regardless of tillage. If the deep soil test is not taken and nitrogen recommendations are made using the less accurate organic matter test, nitrogen recommendations should be increased 30 lb/A from the calculated values.

Surface residues and fewer opportunities for incorporation increase the potential for volatilization losses of nitrogen from surface applied urea. Nitrogen may also be tied up by surface residues. Incorporation or injection of nitrogen fertilizer, therefore, will often result in more efficient nitrogen use.

Topdressed phosphorus fertilizers will remain near the surface with reduced and no-tillage systems. If soil test levels are low or conditions are dry, deeper incorporation, injection, or starter applications may be necessary.

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